PELVIC ACTINOMYCOSIS. UROLOGIC PERSPECTIVE

VENKATA K. MARELLA, OMID HAKIMIAN, GILBERT J. WISE, DAVID A. SILVER

Section of Urology, Maimonides Medical Center, Brooklyn, New York, USA

ABSTRACT

Purpose: Actinomycosis is a chronic granulomatous infection caused by the gram-positive anaerobic bacteria, Actinomyces israelli. This paper reviews the etiology and clinical presentation associated with Actinomycosis that often presents as a pelvic mass that mimics a pelvic malignancy.

Materials and Methods: A combination of patients treated by the authors in the recent past and a literature review of patients with pelvic Actinomycosis were assessed for demographic, clinical and predisposing co-factors. An analysis is made of age distribution, gender, diagnostic methods and treatment concepts.

Results: Thirty-three patients were included in the study that included 2 current patients and 31 obtained from literature review. There were 27 females (age range 16 - 69 years, mean 38 years) and 6 males (16 - 55 years, mean 36 years). Presenting signs and symptoms were lower abdominal mass in 28 (85%); lower abdominal pain in 21 (63%); vaginal discharge or hematuria in 7 (22%). Two patients developed fistulae (entero-vesico 1; vesico-cutaneous 1). Nineteen (70%) of the 27 female patients had intra-uterine contraceptive devices (IUD). Four patients (12.5%) (3 males and 1 female) had urachus or urachal remnants. Cystoscopy in 12 patients noted an extrinsic mass effect, bullous edema and in one patient “vegetative proliferation” proven to be a chronic inflammatory change. Exploratory laparotomy was performed in 32 of the 33 patients who had excision of mass and involved organs. Diagnosis was established by histologic examination of removed tissue. Penicillin (6 weeks) therapy was utilized to control infections.

Conclusion: Pelvic actinomycosis mimics pelvic malignancy and may be associated with the long-term use of intra-uterine contraceptive devices, and persistent urachal remnants. Removal of infected mass and antibiotic therapy will eradicate the inflammatory process.

Key words: pelvis; Actinomycosis; infection; tumor

INTRODUCTION

Actinomycosis is a chronic granulomatous infection caused by the gram-positive anaerobic bacteria, Actinomyces israelli, which often occur in clusters of tangled filaments called sulfur granules. Actinomyces is a natural inhabitant of the gastrointestinal tract. Clinical actinomycosis includes cervicofacial (60%), thoracic (15%), abdominal/pelvic (25%) (1).

Actinomycosis is a chronic infection characterized by the presence of dense fibrous tissue and pus. This infection does not invade intact mucous membranes, and commonly requires tissue trauma or the presence of foreign body. Abdominal surgery, ruptured viscus, tubo-ovarian abscess and intra-uterine contraceptive devices (IUD) are recognized risk factors for abdominal/pelvic Actinomycosis (2). In females, actinomyces are thought to be induced by oro-genital contact (3).
The Actinomycetes have been considered as “transitional forms between bacteria and fungi” however, their metabolic and morphologic characteristics classify them as higher forms of monera (bacteria). Actinomycosis is a chronic suppurative infection, which rarely involves the genitourinary system. Only 2 cases of abdominal Actinomyosis were encountered in 5 major hospitals with 640,000 admissions during 1955 to 1964 (4).

Recent presentations of 2 patients with genito-urinary Actinomycosis and a review of literature indicate that pelvic infection may be more prevalent. This paper presents an assessment of patient with pelvic Actinomycosis, and the associated risk factors.

Diagnosis is essential to differentiate the inflammatory mass or pseudotumor from malignant process.

MATERIALS AND METHODS

A literature review of 31 patients and 2 recent patients were evaluated to determine demographics, etiologic and clinical patterns of patients with pelvic infection caused by Actinomycosis.

RESULTS

A total of 33 patients with pelvic Actinomycosis are cited (Table-1). Twenty-seven patients (81%) were female with age range of 16 - 69 years (mean 38 years) and 6 male (18%) with age range of 16 - 55 (men 36 years). Four patients (3 male and 1 female) had urachus or urachal remnants. Nineteen (70%) of the 27 females had intra-uterine contraception devices.

Cystoscopy was performed in 12 patients. Findings included extrinsic mass effect, bullous edema and in one patient “vegetative proliferation” that revealed chronic inflammatory change. Exploratory laparotomy was performed in 32 of the 33 patients with excision of mass and involved organs (salpinx - 6; hysterectomy - 2; cystectomy or partial cystectomy - 10) Two patients required urinary diversion and 1 undiversion following determination that the mass was inflammatory.

The authors recently treated 2 patients with pelvic Actinomycosis. A 43-year old female presented with 2 months history of right lower quadrant abdominal pain associated with weight loss. Past history included 2 caesarian-sections and intrauterine device for 9 years, which was removed 1 month prior to admission.

Physical examination revealed a firm, tender right lower quadrant abdominal mass. No cervical motion tenderness was appreciated. Patient’s laboratory evaluation revealed no leukocytosis, and normal urinalysis. Computed tomography (CT) showed a predominantly right sided mass involving the anterior abdominal wall, small bowel and dome of the bladder (Figure-1).

Laparotomy confirmed a firm mass, extending from anterior abdominal wall to apex of bladder, adherent to right ovary, and ileum. En-bloc resection of bladder dome, right ovary, terminal ileum, appendix and cecum was performed. Histology revealed chronic inflammation with multiple abscesses and clusters of Actinomyces (Figure-2). This patient was treated with intravenous penicillin derivative. There was no recurrence.

Another patient a 39-year old woman had a 2 years history of lower abdominal pain associated with severe urinary frequency. The patient reported a 7-year use of IUD and history of penicillin allergy. Physical examination was unremarkable. Laboratory evaluation revealed no leukocytosis, pyuria, with sterile urine culture. CT showed a cystic mass anterior to bladder (Figure-3). Cystoscopy revealed intact bladder mucosa with edema and impression of extrinsic mass anterior to bladder. Transurethral biopsy was consistent with inflammatory process. Elective CT guided drainage of cystic mass disclosed purulent contents. Although drainage culture was sterile, cytology revealed inflammatory cells with aggregates of Actinomyces. Patient was treated with prolonged drainage of abscess cavity and 6 weeks of oral ciprofloxacin. Two months after removal of the percutaneous drain, patient had recurrence of the same previous symptoms, and the persistent cystic mass was seen on CT imaging. Patient underwent laparotomy, and en bloc excision of cystic mass including the bladder dome. The patient recovered completely after surgery.
A review of 33 patients indicated that the diagnosis was established in 31 (94%) following surgical exploration and removal of tissue mass and affected organs that included portions of bladder, female reproductive organs uterus, salpinx and ovary. Three patients required urinary, bowel reconstruction or fecal diversions.

DISCUSSION

An actinomycotic lesion may present as hard mass with induration that extends to the adjacent organs, resulting in difficult differentiation from malignancy. Genitourinary symptoms are usually non-specific, and may include abdominal pain, urinary frequency, and repetitive cystitis.

There is usually a long interval between the onset of symptoms and establishment of diagnosis. The diagnosis is primarily histological. Cultures are often unsuccessful in determining causative factors.

During the past 3 decades, the medical literature has cited a number of case reports of Actinomycosis of the genito-urinary system. Actinomycosis has caused primary infections of the kidney (5-7), including a horseshoe kidney (8), renal duodenal fistula (9), and reno-colic fistula (10).

Abdominal-pelvic forms of Actinomycosis have mimicked carcinomatosis with presentations of large pelvic mass and multiple peritoneal nodules (11). Other manifestations of Actinomycosis have included retroperitoneal and para-spinal masses (12,13).

Actinomycosis has been known to cause scrotal masses (14,15), infections of the prostate (16) and penile pilonidal sinus (17).

Bladder and pelvic infections have been well documented in the literature. Most patients were women who presented with lower abdominal mass and suprapubic pain (18-20). Pelvic mass was the presentation in most of female patients with actinomycosis, with the history of IUD use. (21-23).

Ureteric obstruction related to pelvic infection has been reported (24). Brown et al. reported a 34-year old female, with ureteric obstruction secondary to IUD-associated actinomycosis, which
<table>
<thead>
<tr>
<th>Study</th>
<th>No</th>
<th>Age (years)</th>
<th>Sex</th>
<th>Presentation</th>
<th>Risk Factors</th>
<th>Cystoscopy</th>
<th>Treatment &amp; Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current study</td>
<td>1</td>
<td>43</td>
<td>F</td>
<td>2 mo., right lower quadrant pain, with weight loss and firm tender right lower quadrant abdominal mass, CT scan showed 5 cm right sided pelvic mass, involving the anterior abdominal wall, small bowel and the dome of the bladder</td>
<td>IUD</td>
<td>N/A</td>
<td>Laparotomy, with excision of the mass with en-bloc resection of the bladder dome, right ovary, and terminal ileum</td>
</tr>
<tr>
<td>Current study</td>
<td>1</td>
<td>39</td>
<td>F</td>
<td>2 yr., lower abdominal pain with severe urinary frequency and unremarkable physical exam, 6 cm cystic mass anterior to the bladder (CT scan)</td>
<td>IUD</td>
<td>Edema and signs of extrinsic compression at dome, biopsy confirms inflammatory process</td>
<td>CT guided drainage and ciprofloxacin for 6 weeks, recurrence of mass after 2 months, required laparotomy with excision of cystic mass and bladder dome</td>
</tr>
<tr>
<td>Beedham et al.</td>
<td>4</td>
<td>29, 19, 44, 24</td>
<td>F</td>
<td>Pelvic mass, vaginal discharge, menorrhagia or amenorrhea</td>
<td>IUD</td>
<td>None</td>
<td>Exploratory laparotomy, penicillin therapy</td>
</tr>
<tr>
<td>Brown et al.</td>
<td>1</td>
<td>34</td>
<td>F</td>
<td>Weight loss and constitutional symptoms, CT and IVP findings of bilateral hydronephrosis and a mass in the pelvis displacing the bladder anteriorly, and a mass in right ischio-rectal fossa</td>
<td>IUD</td>
<td>None</td>
<td>Laparotomy and excision of a friable mass in the pelvis, which displaced the bladder anteriorly, with bilateral pyosalpinges</td>
</tr>
<tr>
<td>Deshmukh et al.</td>
<td>1</td>
<td>57</td>
<td>F</td>
<td>Vesico-cutaneous fistula</td>
<td>Appendectomy, cholecystectomy</td>
<td>Edema at dome</td>
<td>Penicillin</td>
</tr>
</tbody>
</table>

Table 1 – Review of abdomino-pelvic actinomycosis and associated risk factors.
<table>
<thead>
<tr>
<th>Study</th>
<th>No</th>
<th>Age (years)</th>
<th>Sex</th>
<th>Presentation</th>
<th>Risk Factors</th>
<th>Cystoscopy</th>
<th>Treatment &amp; Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ellis et al.</td>
<td>4</td>
<td>16</td>
<td>M</td>
<td>Voiding symptoms and lower abdominal fullness</td>
<td>No</td>
<td>Extrinsic compression on bladder dome</td>
<td>Drainage and marsupialization of the abscess to the abdominal wall</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Right salpingo-oophrectomy, for a mass originating from right ovary</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>F</td>
<td></td>
<td>Lower abdominal discomfort, dyspareunia, and vaginal bleeding</td>
<td>Previous appendectomy</td>
<td>N/A</td>
<td>Hysterectomy for atypical dysplastic cervix, and tubo-ovarian abscess</td>
</tr>
<tr>
<td></td>
<td>29</td>
<td>F</td>
<td></td>
<td>Recurrent PID</td>
<td>IUD</td>
<td>N/A</td>
<td>Laparotomy and excision of 5 x 10 cm abdominal wall mass, with no continuity with abdominal structures</td>
</tr>
<tr>
<td></td>
<td>22</td>
<td>F</td>
<td></td>
<td>Tender Left lower quadrant abdominal mass</td>
<td>Abortion</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Fulton et al.</td>
<td>2</td>
<td>31</td>
<td>F</td>
<td>Right lower quadrant pain, pelvic mass</td>
<td>IUD</td>
<td>N/A</td>
<td>Laparotomy and hysterectomy</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>32</td>
<td>F</td>
<td>Lower abdominal pain, left sided pelvic mass</td>
<td>IUD</td>
<td>N/A</td>
<td>Antibiotic therapy, laparotomy</td>
</tr>
<tr>
<td>Gotoh et al.</td>
<td>1</td>
<td>55</td>
<td>M</td>
<td>Lower abdominal pain and dysuria, CT finding 4 x 8 cm mass from anterior bladder wall to rectus muscle</td>
<td>Urachal remnant</td>
<td>Stretched edematous dome</td>
<td>Laparotomy and excision of the mass and urachal cord with part of bladder and peritoneum</td>
</tr>
<tr>
<td>Grierson et al.</td>
<td>1</td>
<td>68</td>
<td>F</td>
<td>Large, hard, irregular lower abdominal mass left to midline (urachus)</td>
<td>Urachus Appendectomy</td>
<td>N/A</td>
<td>Partial cystectomy and hard, fibrotic mass involving the dome of the bladder</td>
</tr>
<tr>
<td>Henderson et al.</td>
<td>1</td>
<td>38</td>
<td>F</td>
<td>Lower abdominal pain, vaginal discharge and pelvic mass</td>
<td>IUD</td>
<td>None</td>
<td>Laparotomy – tubo-ovarian abscess</td>
</tr>
<tr>
<td>Study</td>
<td>No</td>
<td>Age</td>
<td>Sex</td>
<td>Presentation</td>
<td>Risk Factors</td>
<td>Cystoscopy</td>
<td>Treatment &amp; Findings</td>
</tr>
<tr>
<td>---------------</td>
<td>----</td>
<td>-------</td>
<td>-----</td>
<td>--------------------------------------------------------------------------------</td>
<td>--------------</td>
<td>------------</td>
<td>-------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Isaacson et al.</td>
<td>1</td>
<td>51</td>
<td>M</td>
<td>Hypogastric mass and bilateral ureteric obstruction</td>
<td>None</td>
<td>None</td>
<td>Laparotomy and ureterolysis – Ileocecal mass</td>
</tr>
<tr>
<td>Jackson et al.</td>
<td>1</td>
<td>45</td>
<td>F</td>
<td>Epigastric and back pain, pelvic mass, bilateral ureteric obstruction</td>
<td>IUD</td>
<td>Right</td>
<td>Laparotomy and resection of pelvic mass</td>
</tr>
<tr>
<td>King et al.</td>
<td>1</td>
<td>36</td>
<td>F</td>
<td>Right lower quadrant pain, voiding symptoms and RLQ mass</td>
<td>IUD</td>
<td>Bullous edema of right lateral wall</td>
<td>Laparotomy and partial cystectomy</td>
</tr>
<tr>
<td>Lomax et al.</td>
<td>4</td>
<td>16,28,40,25</td>
<td>F</td>
<td>Pelvic mass, weight loss</td>
<td>IUD (2 patients)</td>
<td>None</td>
<td>Exploratory laparotomy- tubo-ovarian abscesses</td>
</tr>
<tr>
<td>Maeda et al.</td>
<td>1</td>
<td>43</td>
<td>F</td>
<td>Lower abdominal pain and abdominal distension, CT and IVP findings of a pelvic mass causing right hydronephrosis and intestinal obstruction</td>
<td>IUD</td>
<td>N/A</td>
<td>Emergency laparotomy, and incomplete tumorectomy and colostomy and cutaneous ureterostomies due to positive frozen sections for adenocarcinoma, but final pathology revealed actinomycosis, and then underwent urinary undiversion.</td>
</tr>
<tr>
<td>Makar et al.</td>
<td>1</td>
<td>35</td>
<td>F</td>
<td>Lower abdominal pain and urgency, CT findings of mass from anterior portion of bladder with infiltration into rectus abdominis muscle</td>
<td>IUD</td>
<td>Vegetative proliferation at dome</td>
<td>Partial cystectomy, with a 4 cm central exophytic tumor, which was adherent to pubis and omentum</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Study</th>
<th>No</th>
<th>Age (years)</th>
<th>Sex</th>
<th>Presentation</th>
<th>Risk Factors</th>
<th>Cystoscopy</th>
<th>Treatment &amp; Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marco Perez et al.</td>
<td>55</td>
<td>M</td>
<td></td>
<td>Right flank pain – Right sided bladder mass, right hydronephrosis, CT – thick bladder wall on right side and right. hydronephrosis</td>
<td>H/o Bilroth II</td>
<td>Mass effect on right lateral wall with intact mucosa</td>
<td>Exploratory laparotomy and finding of mass with infiltration at bladder, sacrum and posterior bladder with encompassing both ureters. Cystectomy and ileal conduit</td>
</tr>
<tr>
<td>Micheli et al.</td>
<td>1</td>
<td>22</td>
<td>M</td>
<td>Hard, fixed, median umbilical-pubic mass (urachus)</td>
<td>No</td>
<td>Normal</td>
<td>Excision by laparotomy and mass reaching from umbilicus to bladder dome</td>
</tr>
<tr>
<td>Nagy et al.</td>
<td>1</td>
<td>16</td>
<td>M</td>
<td>Palpable, painless umbilical-pubic mass and voiding symptoms (patent urachus)</td>
<td>No</td>
<td>Evidence of external compression up to 3 cm, at dome of bladder</td>
<td>Excision by laparotomy and mass reaching from umbilicus to bladder vertex with terminal ileum involvement</td>
</tr>
<tr>
<td>Ozyurt et al.</td>
<td>1</td>
<td>31</td>
<td>F</td>
<td>Palpable suprapubic mass, with hematuria and CT finding of a 5 cm mass originating from anterior bladder wall.</td>
<td>IUD</td>
<td>Edematous bladder mucosa</td>
<td>Partial cystectomy and right salpingo-oophrectomy, for a firm mass extending from the anterior wall to the apex of the bladder.</td>
</tr>
<tr>
<td>Piper et al.</td>
<td>1</td>
<td>69</td>
<td>F</td>
<td>7 weeks h/o voiding symptoms, and pneumaturia, suggesting entero-vesical fistula</td>
<td>None</td>
<td>Cysto - 4 cm mass effect on right lateral wall IVP - filling defect in bladder, right hydronephrosis</td>
<td>Exploratory laparotomy – mass in right iliac fossa involving a loop of small bowel, bladder, and ovary</td>
</tr>
<tr>
<td>Spagnuolo et al.</td>
<td>1</td>
<td>43</td>
<td>F</td>
<td>Pelvic mass and lower abdominal pain</td>
<td>IUD</td>
<td>None</td>
<td>Exploratory laparotomy-dense fibrous adhesions involving pelvic organs</td>
</tr>
<tr>
<td>Willscher et al.</td>
<td>1</td>
<td>49</td>
<td>F</td>
<td>Right lower quadrant pain, pelvic mass</td>
<td>Ca Cervix</td>
<td>None</td>
<td>Exploratory laparotomy - Pelvic mass, and retroperitoneal fibrosis</td>
</tr>
</tbody>
</table>
responded well to tetracycline therapy alone (25). Another 45-year old female, with IUD use for more than 13 years, presented with bilateral ureteric obstruction secondary to a large pelvic mass involving the uterus, tubes, ovaries, and rectum (26). Fulton et al. reported 2 cases with ureteric obstruction, secondary to IUD-associated Pelvic actinomycosis (27). Tubo-ovarian abscess was reported by Actinomyces bovis, was reported in a 38-year old female with IUD use (28).

One patient’s (20) cystoscopy demonstrated edematous mucosal however this patient presented with a supra-pubic mass that was similar in presentation as the 2 case reports. King et al. reported a bladder mass limited to serosa, associated with IUD use for more than 13 years (29). Other presentations of pelvic actinomycosis with bladder involvement are vesico-cutaneous fistula (30), anterior pelvic masses involving bladder dome (31), and lateral pelvic masses causing ureteral compression (32). Actinomycosis involving the urachus or urachal remnant has been reported. One patient was a 68 year-old woman while the other cases involved men aged 16, 22 and 55 years (18,33-36).

A 16 year-old male developed an urachal Actinomycosis that penetrated into the ileum (37). Ureteric obstruction secondary to retroperitoneal and pelvic Actinomycosis was reported (38,39). Ileo-vesical fistula was reported in a 69 year-old woman due to Actinomycosis (40). All patients presented with suprapubic masses thought to be either an urachal abscess of malignancy. Diagnosis was established following histologic examination of the resected tissue. All patients responded to antibiotic therapy. In most cases of female infection the presence of a long standing (> 6 years) intra-uterine contraceptive device was incriminated as the putative cause of pelvic infection. A number of cases have been related to the use of intra-uterine devices.

In only one patient was the diagnosis of supra vesical Actinomycosis established prior to surgical exploration. This was achieved by CT guided aspiration of supra-vesical abscess. Although the patient had 6 weeks of ciprofloxacin therapy, the mass persisted and the patient subsequently required surgical exploration with excision of supra-vesical mass and partial cystectomy. The literature cites another patient in whom diagnosis was established by drainage from a vesico-cutaneous fistula.

These case reports indicate the potential for Actinomycosis to develop in women with IUD’s. Actinomyces is usually found in gastrointestinal tract. The access to the genital tract is likely to be by oral contact or via blood stream. The disease may become established in the presence of chronic tissue injury from an IUD, and some copper containing IUD’s may have a differential effect on bacterial colonization by anaerobic flora. Luff et al. demonstrated Actinomyces in 40% of hysterectomy specimens removed from IUD wearers for various reasons (41). Thus, with chronic inflammation and mucosal breakdown associated with IUDs appears to favor colonization, and subsequent development of suppuration. Urachus or urachal remnants also appear to be a co-factor. Intestinal perforation with ileo-cecal involvement is also a potential risk factor for pelvic actinomycosis. Awareness of these contributing factors may interdict the need for aggressive surgery utilized in the treatment of malignant processes.

The treatment is a combination of extensive surgical debridement and/or long-term antibiotic therapy. Penicillin is the drug of choice. If diagnosed pre-operatively, should start with 10 to 20 million units of intravenous penicillin per day for 4 to 6 weeks.

Then wide excision of the infected tissues and exposure of any sinus tracts should be performed. After surgery, the patient should receive 1 to 2 million units of oral penicillin continued for 12 to 18 months. If the diagnosis is made at the time of surgery, 10 to 20 million units of intravenous penicillin, and then long-term oral penicillin therapy is needed. Tetracycline, erythromycin, clindamycin and ciprofloxacin are the alternative antibiotics in the management of patients with penicillin allergy.

CONCLUSIONS

The presentation of 2 recent case reports and review of 31 cases cited in the literature reiterate the importance of this diagnostic entity when the urologist encounters a patient with an unusual pelvic mass. The presence of long-standing contraceptive intra-uterine
device is the most significant contributing factor in
the female patient. An urachus or urachal remnant is
also an associated risk factor.

Surgical resection combined with penicillin
therapy was proven to be successful. In most patients,
the diagnosis was established after exploratory
surgery following extensive resection of infected
tissue. Awareness of this diagnostic entity may enable
the urologist to implement antibiotic therapy and
minimize the need for major organ resection.

REFERENCES

Press, 1938.
2. Schiffer MA, Elguezabal A, Sultana M, Allen AC:
Actinomycosis infections associated with intrauterine
actinomycosis in the presence of an intrauterine device.
4. Weese, W.C., Smith, IM: A study of 57 cases of
Actinomycosis over 36 year period. A diagnostic
“failure” with good prognosis and treatment. Arch Int
6. Crosse JE, Soderdahl DW, Schamber DT: Renal
actinomycosis: nephrectomy can be avoided. Report
8. McGibney D, Clarke PB: Primary renal actinomycosis
58: 566.
9. Cvetkov MC, Elenkov C, Georgiev M, Topov U,
Stefanova G: Renal actinomycosis complicated by
1995; 75: 104-5.
10. Yu HH, Yim CM, Leong CH: Primary actinomycosis
1978; 50: 140.
11. Cameron AE, Menon GG, Wyatt AP: Abdominal
actinomycosis mimicking carcinomatosis. J R Soc
12. Schlech WF 3rd, Gelfand M, Alper B, Kaiser AB:
Medical management of visceral actinomycosis. South
13. Levine LA, Doyle CJ: Retroperitoneal actinomycosis:
14. Sarosdy MF, Brock WA, Parsons CL: Scrotal
15. Jani AN, Casibang V, Mufarrij WA: Disseminated
actinomycosis presenting as a testicular mass: a case
16. de Souza E, Katz DA, Dworzack DL, Longo G:
17. Rashid AM, Williams RM, Parry D, Malone PR:
Actinomycosis associated with pilonidal sinus of the
18. Ellis LR, Kenny GM, Nellans RE: Urogenital aspects
19. Makar AP, Michielsen JP, Boeckx GJ, Van Marck EA:
Primary actinomycosis of the urinary bladder. Br J
N: Actinomycosis simulating bladder tumour. Br J
Female genital actinomycosis. Eur J Obstet Gynecol
22. Spagnuolo PJ, Fransioli M: Intrauterine device-
associated actinomycosis simulating pelvic
23. Lomax CW, Harbert GM Jr, Thornton WN Jr:
Actinomycosis of the female genital tract. Obstet
T, Aoki Y, et al.: Urinary undiversion for pelvic
6: 111-3.
27. Fulton IC, Paterson WG, Crucioili V: Pelvic
actinomycosis causing ureteric obstruction. Case
28. Henderson SR: Pelvic actinomycosis associated with
an intrauterine device. Obstet Gynecol. 1973; 41: 726-
32.
29. King DT, Lam M: Actinomycosis of the urinary
bladder. Association with an intrauterine contraceptive

Received: June 28, 2004
Accepted: August 20, 2004

Correspondence address:
Dr. Venkata K. Marella
Section of Urology
Maimonides Medical Center
953, 49 st, # 301
Brooklyn, New York, 11219, USA
Fax: + 1 718 635-7093
E-mail: vkmarella@hotmail.com